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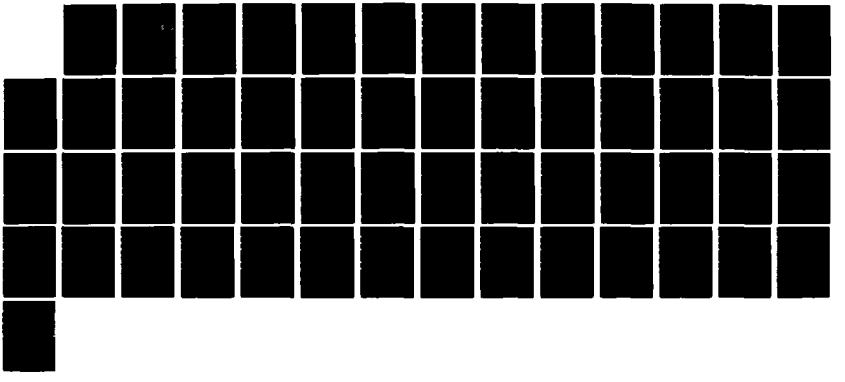

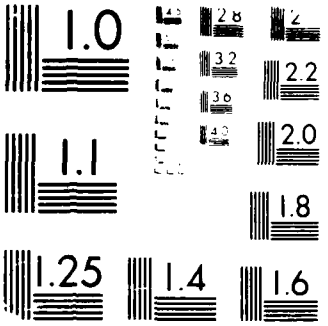

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C3 on the AirLand Battlefield. : Striking a Balance Between Communications Means and Information Needs

by

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The need to communicate via electronic means on the battlefield has increased dramatically since WWI. The two most significant factors underlying this change are greater tactical dispersion and the tempo of combat operations. Tactical dispersion, caused by the tremendous lethality of modern weapons, poses a control problem for commanders who must generate combat power at the right place and time on the battlefield. The ability to synchronize the battle will depend on established C2 systems and communications means. One challenge is to employ communications systems (technical means) that will meet the demand to process information requirements generated by command and control systems. A second challenge is avoid the dilemma created by requirements that exceed the capability of the technical means. A degraded, and therefore less responsive, C3 posture could spell disaster on today's lethal battlefield. (continued on other side of form)

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The effort to address these issues begins with a brief historical review of communications means and needs. Next, this study looks at the impact that doctrine has on the subject. The paper explores the application of technology to doctrine to determine whether near-term improvements in terrestrial communications systems will meet AirLand Battle information needs.

This monograph finds that terrestrial C3 systems -- MSE and SINCGARS -- scheduled for near-term fielding will meet communications needs on the AirLand battlefield under one condition. The Army and its leadership must appraise information needs within the context of the doctrinal basis for AirLand Battle -- decentralized execution.

This study recommends that commanders at all levels actively seek to implement the concept of decentralized execution as expressed in AirLand Battle Doctrine to produce a consequent reduction in information needs.

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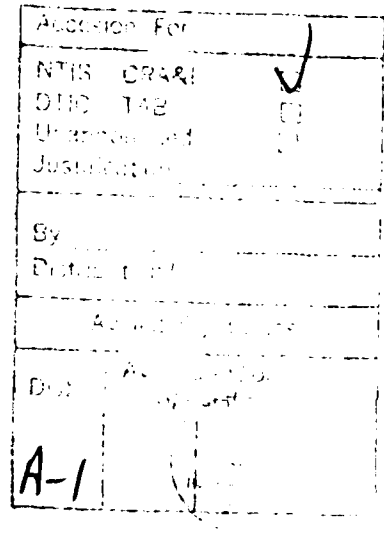

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ABSTRACT

C3 ON THE AIRLAND BATTLEFIELD. : STRIKING A BALANCE BETWEEN COMMUNICATIONS MEANS AND INFORMATION NEEDS.

The need to communicate via electronic means on the battlefield has increased dramatically since WWI. The two most significant factors underlying this change are greater tactical dispersion and the tempo of combat operations. Tactical dispersion, caused by the tremendous lethality of modern weapons, poses a control problem for commanders who must generate combat power at the right place and time on the battlefield. The ability to synchronize the battle will depend on established C2 systems and communications means. One challenge is to employ communications systems (technical means) that will meet the demand to process information requirements generated by command and control systems. A second challenge is to avoid the dilemma created by requirements that exceed the capability of the technical means. A degraded, and therefore less responsive, C3 posture could spell disaster on today's lethal battlefield.

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I. Introduction

Fleet Admiral Sergey Gorshkov, commander of the Soviet Navy once stated that "the side that controls the electromagnetic spectrum in the next war will win."[1] When one pauses to consider the U.S. Army's reliance on satellite communications, precision guided munitions, air defense radars, automated battlefield systems and dozens of similar systems, Admiral Gorshkov's statement begins to grow in significance. This concept of control of the electromagnetic spectrum gives rise to two possibilities. One is that control is gained through the development of electronic communications means that are extremely survivable and able to function on the chaotic AirLand battlefield. The other is that control is gained by denying use of the electromagnetic spectrum to the enemy. This paper will address the former.

A corollary to control of the electromagnetic spectrum is that advantage will go to the side which, by virtue of its command and control (C2) process, is less vulnerable to degradation of its technical communications means. The C2 process, to be effective on the battlefield, must account for periods of severe degradation in voice and data communications. The C2 process must allow, through its design and philosophy, the exercise of initiative and independent action on the part of field commanders and their subordinates during

communications outages. Given a survivable communications system and an efficient C2 process, the question becomes one of integrating the two to use the command control communications (C3) system effectively.

This necessarily raises the subject of information needs on the battlefield, and whether the communications means will be able to satisfy those needs. Hard choices are involved. Commanders must differentiate between communications wants and communications needs in consonance with established doctrine as they establish their critical information requirements. The commander's staff must then balance those needs with the extant communications means. It is the thesis of this paper that communications means will meet communications needs if, and only if, decentralized execution, as adopted by the Army in the AirLand Battle doctrine, is embraced by leaders at all levels of command.

Providing the commander with the means to direct the concentration of his forces at the decisive point at the right time is the ultimate C3 challenge.[2] The dispersed nature of AirLand Battle makes this task ever more difficult. Technology, however, now offers a vast array of C3 and C3I systems to commanders and staffs. Positive navigation systems, plasma displays of exact unit locations, real-time intelligence updates via satellite and reconnaissance aircraft downlinks all promise to reduce the uncertainty in war. Unfortunately, chaos on the three dimensional battlefield will also reduce the

effectiveness of all systems, not the least of which will be the communications systems that link sensors and observation platforms to command posts.

The challenge, then, is to take advantage of technological advances to improve the commander's ability to see and control the battle while maintaining the ability to prosecute the battle, when necessary, without those technological advantages. Research and development of advanced, satellite-based command control communications (C3) systems is necessary and good, but we must never lose the capability to control the battle by more conventional means. When satellites are destroyed or become overloaded, it is the terrestrial C3 systems that will continue to provide the critical links.

The methodology for this paper is first to look briefly at several historical periods to review the evolution of communications means and information needs. Next, the impact of AirLand Battle doctrine is considered to show how it influences communications needs on the modern battlefield. The paper then focuses on two terrestrial voice/data tactical communications systems scheduled for fielding in the near-term and discusses how their capabilities support implementation of current doctrine. A critical look is then taken at factors that influence the Army's ability to achieve effective command, control and communications in light of threat capabilities and present U.S. Army practices.

The final section of the paper presents conclusions concerning the adequacy of communications means to meet information needs; recommendations then follow suggesting practical ways to increase the responsiveness of C3 systems.

In a simpler age, when combat had the personal aspect of face-to-face encounters, and combat leaders could trust their actions and voices to control the battle, it would have been impossible to imagine the complex nature of war today. The technological advances in weaponry and communications-electronics have created a tremendously lethal battlefield on which the soldier must fight and win. In the military, as in many other disciplines, an appreciation of the present depends in large measure on knowledge of the past. History shows us the path that led from simplicity to complexity.

II. Historical Background

The evolution of communications means and information needs could easily be the basis for a detailed and lengthy study. That is not the purpose of this paper. A brief look back into history, however, is necessary to fully appreciate the complexity of today's C2 challenges.

Two categories of information have always been important to combat commanders; combat information, and intelligence.[3]

> Combat information is raw data which can be passed directly to combat and combat support units to be used for fire and maneuver without interpretation, analysis, or integration with other data. Intelligence is data which requires some form of validation, integration and comparison with other data, or analysis before it can be used or fully exploited.[4]

As the complexity of combat operations and the area of the battlefield have increased through the ages, increasing demands have been placed upon the means on communications to satisfy information needs.

Commanders have always had the need to mass soldiers (combat power) at the decisive point to engage and defeat an enemy. As men formed groups for protection or expansion of their territory, the localized nature of operations made a commander's information needs rather simple. Strength and condition of friendly forces was readily apparent to the commander as he was immediately in charge of his entire army.

The commander also had the necessary combat information directly at his disposal due to his physical presence on the battlefield. Often, however, his involvement in physical combat narrowed his view to his immediate vicinity.

In the age of unitary armies, the commander had little difficulty determining the status of his own forces; it was information on the enemy's location, strength and disposition that formed the nucleus of critical information requiring a means of communications. A commander's technical communications means consisted primarily of messengers and visual signalling.

Frederick the Great's subdivision of the fighting army and his dispersed troop garrisons created the need for a rudimentary staff to attend to the concentration, movement and provisioning of his army. Beyond this, however, his information needs had changed little from commanders of previous centuries; intelligence concerning the enemy was still the pressing need. Postal services were somewhat more developed in Frederick's time, but time-sensitive messages still basically traveled at the speed of a horse or as fast as signal towers could relay information.

Napoleon's innovation of the corps concept, the frequent dispersion of his forces during operations and the habit of granting considerable responsibility to his Marshals created the need for a system of regular reports to keep abreast of the

condition and disposition of his own forces. Communications means were still very rudimentary, although messages sent via signal stations were often relayed at amazing speeds.[5]

The American Civil War saw the first use of the telegraph by U.S. forces, thus allowing rapid influence from rear area commanders and Washington itself. This proved to be both a blessing and a curse. Sun Tzu, the ancient military commentator and practitioner warned against advancing or retiring an army when ignorant of the situation. "No evil is greater than commands of the sovereign from the court."[6]

With the advent of true world war in 1914 and the advances in weapons technology and mechanization, commanders were faced with tremendously increased and complex combat communications needs and grossly inadequate means. WWI communications means were restricted primarily to the field telephone, the telegraph, and messengers (runners). The first two means allowed higher level commanders to remove themselves from the battlefield and direct operations from the rear.

> The diabolical effect of even such a relatively simple instrument as the field telephone is that it may come to command the commander. It chains him to a system of remote control. At first he sees it only as a useful channel for quick communication in combat. Then he fears to leave it lest it should require his presence in headquarters the moment after he leaves to go forward."[7]

The third means, messengers, were required due to the level of technology and the nature of the battlefield.

Communications to the front lines was generally reliable but from the front lines forward, no reliable means existed.

> Forward of Division, to Brigade and Battalion, the lines left their poles to descend earthwards, becoming 'land lines', by this stage of the war no longer strung vulnerably along the walls of the communications trenches but buried under the duckboards on the floor. The nearer it approached the front trench, the deeper it was buried, until in the forward zone it reached a depth of six feet. The installation of this 'six-foot bury' had been one of the most time-consuming preparations for the offense, but it was justified by the security of communication it provided even under the heaviest enemy shellfire. It had, however, one disabling shortcoming: it stopped at the edge of no-man's-land. Once the troops left their trenches...they passed beyond the carry of their signals system into the unknown.[8]

Artillery made use of wire all but impossible and no means yet existed for easily portable tactical radio communications. The accuracy and range of artillery, coupled with the tremendous lethality of the machine-gun, created the phenomena of "no-man's-land"; communications from this part of the battlefield was impossible except by runner -- and that was a very hazardous occupation.

Perhaps as in no other war to date, did the disparity between communications needs and means impact with such catastrophic consequences as during WWI. As we have seen, there was no possibility of adjusting artillery fire to support the attack forward of the trenches due to lack of communications. Also, any tactical advantage gained by assault forces could not

be exploited as commanders could receive reports only by runner; temporary advantages achieved at high human cost were almost always lost by the time reports on the tactical situation reached the rear.

During the inter-war years, the introduction of tactical radio communications was greeted with enthusiasm and caution. Its advantages over previous means were obvious; however, there remained the problem of radio transmission intercept which made the use of encryption mandatory and relegated the radiotelephone to an auxiliary role.

WWII saw few changes from WWI concerning information needs on the part of the allies; what had changed were the communications means available to the commander. He was now free to roam the battlefield without isolating himself from his command center. The tactical radio did more to support maneuver warfare than any other invention save the internal combustion engine. The degree of mechanization was such that rapid movement and concentration of forces was now possible; units were also controllable over extended distances through use of the radio.

U.S commanders in WWII also recognized that the tempo of battle required more decentralization.

> Speed and mobility were the hallmarks of the 4th Division. Consequently, land wire communications were all but impossible to use. Radio was the main means of communications. However, due to the speed of advance and dispersal of the units, combat commands were often out of

> communication with the Commanding General and/or the Division Command Post. In these situations, the missions and objectives remained the controlling factors in the absence of communications.[9]

Unfortunately, a bad habit was also developing in regards to use of the radio for command and control -- an incessant quest for combat information that carried through Viet Nam and is with us to this day. What history tells us about the present state of information means and needs is perhaps best epitomized by an example that Marshall give in his book, Men Against Fire. He relates the story of a company commander in the Pacific during WWII who joins one of his platoons to get away from the telephone. He was avoiding the constant requests from his battalion commander for fresh progress reports every fifteen minutes. The battalion commander was trying to placate the regimental commander who, in turn, was trying to satisfy division. "It is the worst vice in operations and it is no respecter of persons; the victim is as likely to be a division commander as the leader of a platoon".[10] The observations of several high-ranking German generals after WWII, concerning improvements in communications during the war are also enlightening.

> ...they felt hamstrung by the fielding of communications equipment vastly superior to that of World War I. Because subordinate commanders possessed the ability to do so, the superior commander expected the subordinates to report every decision to him. This led the superior to express an opinion on all decisions subordinates rendered, since now,

> being aware of the decision, he was himself partly responsible for them. The net effect of improved ability to communicate was that the subordinates grew reluctant to make decisions on their own, in that they had to accept full responsibility for their decisions....Subordinates, then, found themselves tied in knots by the very technical development that was supposed to have improved their lot."[11]

We have seen from this historical review that as the size of armies and scope of operations increased, the commander's information needs changed drastically. He can no longer gain an appreciation for the condition of his forces through personal observation. He is dependent to a great extent upon reports to satisfy his combat information and intelligence needs. The commander can no longer hope to personally and directly control all the forces of his command. His dependence on combat reports arriving at the command is in tension with his need to be forward at the decisive point commanding his units.

Decentralization appears to be the solution to this problem. If the commander cannot be everywhere at once, then his subordinate commanders need to be an extension of his will. As we shall see later, the required technical means of communications are at the commander's disposal. The larger question is how much freedom will he allow his subordinates to exercise their initiative to accomplish the mission? Doctrine should guide the commander's decisions in answering this question.

III. Impact of Doctrine

> Whenever possible, subordinate leaders should receive their orders face-to-face from their commanders on the ground chosen for the operation. Commanders should restrict the operations of their subordinates as little as necessary. Mission orders that specify what must be done without prescribing how it must be done should be used in most cases.... The larger force should remain alert to and be prepared for exploitation of advantages developed by subordinate units through the course of any action.[12]

If we agree that doctrine, to be effective, must be accepted as a common base for action, then the C2 system that derives from that doctrine should be uniformly adopted and used by commanders; only then can a C3 system can be developed to support the C2 process. "Before the need to communicate can be reduced, there must be a universally accepted framework."[13] This section will examine current doctrine, its impact on information and communications needs, and the C2 system it demands.

The C2 system itself has three components:

1) "The command and control organization (command and staff)

2) The command and control process, and

3) The command and control facilities (command posts and communications facilities)."[14]

The command and control process would ideally not require control at all. "In a perfect world where subordinates fully embraced the will and intent of the commander, and executed

those without flaw, control would not be necessary."[15] The perfect world described above should also include an enemy who cooperates fully and creates no surprises. Since the perfect world does not exist, control is necessary; the question becomes how much control is appropriate for the AirLand Battle Doctrine? "Success in battle will require a combination of command and control; however, effort should be directed toward emphasis on command, minimizing necessary control."[16]

Two basic approaches to the C2 process present themselves: centralized planning and execution, and centralized planning with decentralized execution. AirLand Battle Doctrine calls for the latter; human nature usually causes us to adopt the former. The difficulty in operating under the idea of decentralized execution is that the U.S. Army has not set the necessary preconditions. Decentralized execution "rolls easily off the tongue"; putting it into practice is another matter entirely. The German Army's concept of Auftragstaktik has much to offer in the way of example concerning decentralized execution and how to achieve that goal. Auftragstaktik is often loosely translated as a mission-oriented approach to command and control.

> The technique of "mission-oriented orders" forms only the "tip of the iceberg" in understanding the full scope of Auftragstaktik. Rather, it is an all-encompassing concept, holistically embracing elements of what today would be called the theory and nature of war, character and leadership attributes, tactics, command and control, senior-subordinate relationships, and training and education.[17]

Current doctrine with its emphasis on initiative and adherence to the commander's intent, contains many Auftragstaktik-like concepts; they are demanded by the complexity of the modern battlefield. Doctrine establishes a battlefield framework that consists of the close, rear, and deep battle areas, each of which has communications needs and means. These battles are not fought in isolation, but affect one another. The commander, therefore, must ensure that each area has the combat assets allocated or available to meet potential threats.

At corps, the responsibility for rear battle often is given to the deputy corps commander who operates from the rear command post. The chief of staff is usually responsible for the main command post and the G3 handles the tactical command post. The commander is thus free to roam the battlefield and position himself where he can best observe or influence the battle. The extended area of operations and responsibility created by this doctrine plus the dispersion required due to increased lethality of modern weapons significantly increase the challenge to communications systems both in terms of range and netting requirements. Feedback to the commander in terms of combat information and intelligence requires solutions to these communications challenges.

The nature and operation of the feedback system is the crux of C2 and drives the requirements for C3. Doctrine here plays a significant role. The cycle of command begins with

gathering information on friendly forces, enemy forces, the terrain and the the weather; it culminates in execution that must be monitored by a feedback system.[18] This feedback comes from many sources. The commander himself often serves this function upon returning from the forward units. The commander can also make use of "directed telescopes", i.e., those members of his staff who are forward and able to observe the battle or units of the command. "It explains how a commander can, on the one hand, decentralize decision power and drastically reduce communications between echelons and on the other know whether subordinates are following his intent."[19]

Feedback also comes in the form of reports from subordinate commanders and their command posts. Both electronic means of communications and messengers contribute to this vital flow of information.

> The system used to coordinate and exchange information must be keyed to the commander's critical information requirements (CCIR)..... This system must facilitate the decision-making process by limiting information input and minimizing the reporting workload of subordinate headquarters.[20]

We have seen that doctrine stresses minimizing control and the reporting workload of subordinate headquarters. Fortunately, these are mutually supporting goals. The commander, however, must always retain the capability to control if necessary, and have the means available with which to do so.

These two concepts are also mutually supporting. A command and control system not clogged with information of questionable value will operate more efficiently and be more responsive.

Under AirLand Battle doctrine, the emphasis is to have the commander well forward. Richard Simpkin is one of the foremost proponents of forward command: the commander must be forward to feel the battle and to be able to "bring his full professional judgment to bear on the form and timing of the maneuver."[21] Ideally, the command group would be able to maintain contact with the tactical command post and the main command post, in order to be able to both receive information and provide input for the staff planning elements. Both the tactical command post and the main command post must be able to control the battle.

Freedom on the part of the forward commanders to take advantage of fleeting tactical opportunities, in accordance with the commander's intent and without waiting for approval, is necessary if we hope to achieve surprise in battle. Sun Tzu gave sage advice here:

> Now in war there may be one hundred changes in each step. When one sees he can, he advances; when one sees that things are difficult, he retires. To say that a general must await commands ... in such circumstances is like informing a superior that you wish to put out a fire. Before the order to do so arrives the ashes are cold.[22]

We have seen that doctrine has forced decentralization by expanding the battlefield to include the rear, close and deep battle areas. To "strike while the iron is hot" requires minimizing control and allowing leaders at all levels to use their initiative when fleeting tactical opportunities arise. Doctrine also demands synchronization, which in turn requires an effective feedback mechanism to alert the commander to subordinate initiatives. If doctrine requires decentralization and decentralization requires feedback for effective control and synchronization, then the means to provide that feedback becomes a key concern.

The technical communications means necessary to provide timely feedback is a vital link to success in AirLand Battle. We will now consider two C3 systems designed to provide that link.

IV. Applying Technology to Doctrine

A sound warfighting doctrine serves as the foundation for an army. The design of a command and control system to support that doctrine is critical to success on the battlefield. Choosing a communications systems to increase the efficiency of the C2 system is an essential but difficult task; it is complicated by the fact that the Army has not clearly defined its information needs. Technicians have had to make an educated guess concerning information needs in their attempt to provide adequate C3. The systems of choice bear a close look to fully understand their capabilities and limitations.

The tenets of AirLand Battle -- initiative, agility, depth, and synchronization -- place heavy reliance on the command and control system. In his paper "Principles of Military Communications for C3I", LTC Dale Fincke identifies five operational principles (continuity, homogeneity, versatility, security and simplicity) and describes a conceptual communications system that supports the U.S. Army AirLand Battle doctrine.

> Before describing the conceptual military communications system, a word of caution is required. Even if the optimum communications system, based on the proposed principles, were instantaneously available in the field, one should not expect an automatic improvement in the C3I capability available to the commander and his staff. This is because communication is but one element in the total C3I information acquisition and transfer process. While the most important, for it must carry out the exchange of information under all combat conditions, communications

> still plays a relatively minor role in overall command and control. Consequently, changes only in communications will not necessarily lead to a significant increase in effective command and control.[23]

In applying communications technology to a warfighting doctrine, the necessary first step is to understand the doctrine and its ramifications. With the introduction of modern communications technology, the tendency has been to develop and satisfy communications wants rather than needs, at the expense of redundancy, agility, and leadership. The advantages and improvements promised by technology will be only cosmetic unless communications needs are tailored to AirLand Battle Doctrine. Indisciplined use of advanced C3 systems will negate inherent system redundancies by "clogging" available channels. The leadership necessary to establish and enforce communications discipline is easily abrogated by calling for more telephones and circuits, rather than discerning between communications wants and needs.

The problem is that the Army has not defined its communications needs, although there is an ongoing and continuing effort to determine critical information requirements. Elaborate models, numerous surveys and contracts to independent "think tanks" represent efforts to narrow the range of information down to manageable levels to give the commander the information he needs to conduct and win the battle. One recent study identified

seven critical information elements: command mission, command guidance, enemy situation, assets available, task organization, concept of operation and adjacent unit situation. These seven items of information were a subset of eighty-five items considered critical by the Army.[24]

Even when those communications needs are refined and reduced to a manageable number by the army, commanders will personalize those needs to suit their style of leadership and the capabilities of their subordinate commanders. The value of the army-defined information needs is that they will serve as a common base which may be tailored to fit the situation.

At the heart of AirLand Battle Doctrine is the concept of centralized command and decentralized control. The latter will have a significant impact on the amount and type of information required by the commander. One corps commander with an offensive mission in Europe paints a vivid picture of AirLand Battle that speaks directly to the difficulty of providing continuous communications.

> In III Corps operations, nothing will remain out of action for long and today's leaders will never have the luxury of static, localized responsibilities. The leading units will change frequently, trailing units will be committed as openings appear and meeting engagements occur, and the main effort will shift as the situation develops. For these reasons, the Corps holds no reserves; all uncommited units are attack forces, preparing themselves for immediate commitment when an enemy weakness is created or detected. Also for these reasons, leaders of the Corps are expected to know their commander's concept for each operation and to act independently to achieve his intent

when unforeseen opportunities arise.[25]

The fluidity of operations described above is one of the primary characteristics of AirLand Battle. To support such a scenario of combat operations requires a C3 system that is survivable, mobile, and versatile:

A. The C3 system must not constitute a lucrative target. Its survival and proper functioning allow the commander to realize the potential of his combat power. Although C3 in and of itself is not an element of combat power, it serves as a combat multiplier; without it, the true elements - firepower, maneuver, protection, leadership - cannot be brought to bear to their full extent.

B. The C3 system should be capable of keeping pace with the tempo of battle. A mobile system, in addition to being able to keep up with force it supports, provides a measure of protection through frequent displacement.

C. The tactical C3 system must allow the commander freedom on the battlefield and support his "directed telescopes".

It should be noted that a C3 system's survivability is also increased through the last two desired characteristics, mobility and versatility.

Two C3 systems, Mobile Subscriber Equipment (MSE) and Single Channel Ground Air Radio System (SINCGARS), promise to

vastly improve ground tactical communications support. MSE is an area communications system; it is the primary means of communications at corps and down through brigade level. SINCGARS is a combat net radio system that provides reliable, secure voice and data communications; it is the primary means of communications below brigade.

MSE replicates the capabilities of a commercial telephone system in a field environment to include features such as direct dial, call forwarding, automatic conferencing and mobile radio telephone service provided by the Mobile Subscriber Radio Telephone (MSRT). The user does not need to know the network configuration, nor does he need to know the location of those he wishes to contact.[26] A corps commander, for example, could move in his vehicle from one of his divisions to another in his MSRT equipped vehicle without losing telephonic contact. A green light on the MSRT indicates that he is still in range of one of the numerous radio access units associated with the nodes covering the corps and division areas. If the MSRT loses the signal to one access unit, it automatically searches for another and "logs on" or reaffiliates as expressed in MSE language. The radio access makes it possible for even the most forward-located user to remain integrated into the total network.

The forty-two node centers located throughout the corps and division areas provide an automatic alternate routing capability that ensures continuity of communications despite

damage, equipment failure or traffic congestion. If one or several nodes are destroyed, MSE automatically searches for another path throughout the communications grid to complete the circuit.

Each node center has associated with it both large and small extension nodes which further extend the communications system to combat, combat support and combat service support units in the corps and division areas. Node centers will usually be separated by 35 to 40 km and will be connected by radio links to at least three other nodes to provide the grid network (see appendix A). The system is designed to cover a 37,500 km corps battle zone.

> Geographical considerations and equipment availability normally will not allow a perfect grid distribution. There will most likely be zones not covered, creating voids in the grid network while areas of heavy subscriber density will have a closer concentration of nodes.[27]

Small extension nodes (SEN) would typically support battalion-sized elements (except maneuver) and command post of unit headquarters in the corps area. Large extension nodes (LEN) have the capacity to support large units or clusters of units on the order of size of COSCOM or DISCOMs. Altogether, a five-division corps MSE system is comprised of 224 SENs and 9 LENs, in addition to the 42 node centers. A second terrestrial C3 system suited to meet the AirLand Battle communications challenge is SINCGARS.

Although the SINCGARS radio has approximately the same range and siting requirements as the VRC-12 it replaces, its significant advantage lies in the fact that it is a frequency hopping radio that virtually eliminates the current threat from Soviet jammers and interception devices. This is critical below brigade level, where FM is the primary means of communications, since units here are well within enemy artillery range.

Keeping pace with the tempo of battle is MSE's "forte". With a thirty minute average set up and tear down time for node centers, and even less for small and large extension nodes, signal assets should no longer constrain rapid relocation of command posts. The homogeneous nature of MSE also allows division, brigades and battalions within the corps to move to new assembly areas or join combat at a new location with no apparent change in telephone service. Enroute, commanders and staffs with mobile radio telephones remain integrated into the telephone system. At the new unit location, the nearest node center recognizes the unit and electronically routes all calls from the previous location to the new location.

SINCGARS is also well-suited to the rapid tempo of operations. In addition to the well-recognized benefits of secure FM radio communications, SINCGARS also allows the commander to rapidly change nets as he moves about the battlefield. Six presets are available which change the frequency hopping pattern and cryptonet variable for as many

nets. The division commander, for example, have a mix of brigade and battalion presets in his radio that correspond to the area of the battlefield he perceives will be decisive. The SINCGARS radio will allow the commander to quickly gain contact with subordinate command nets and thus improve the effectiveness of the "[illegible]". As he moves to that location [illegible], he will be able to monitor activity [illegible]. "By getting through the [illegible] way from the bottom up, the [illegible] gain immediacy and veracity."[illegible]

MSE and SINCGARS also support the concept of "optional control" by virtue of the capability to "dial direct" with MSE or select a SINCGARS preset to enter a subordinates command net as described above.

The technology embodied in both MSE and SINCGARS thus permits the commander greater freedom on the battlefield. A corps commander, for example, may select anyone he wishes to be in the command group; let us propose that it consists of the commander, his artillery brigade commander and his aviation commander. By having this highly mobile group forward near the critical division's tactical command post, the commander can directly influence the battle with corps assets at a moment's notice. He will have no problem contacting the division commander on his command FM net to help synchronize those assets

into the division close battle. He is at the decisive point of battle and does not have to rely on sketchy or confusing reports from the front as the basis for his actions.

> The chief in whose hands the direction of operations will be concentrated ... must select the location for his own dispositions so that, during the day, he will be able to have exhaustive data on the course of combat operations at the front, even in a case where technical communications refuse to operate for some reason or another.[29] The initiative of battalion commanders will be critical in this battle. They will be in the best positions to evaluate the action and they will be expected to act aggressively and independently to accomplish their division commander's intent.[30]

At the same time, the corps, division or brigade commanders and staff have access to their command posts through the nodal MSE system via the MSRT in their vehicles to coordinate the use of assets controlled by their headquarters.

Both MSE and SINCGARS fielding plans are based on the concept of decentralized support. Many of the services formerly provided by signal units will now fall to the supported unit. The communications centers, now found at signal centers for transmission of "hard copy" message traffic, will be replaced by the user owned and operated facsimile and data devices.[31] At node extensions, signaleers will install a junction box at a suitable location near the center of mass of units in the area. The units themselves will then be responsible to run field wire to the box to establish telephonic and data communications. Units will also be responsible to install, operate and maintain

their telephones and other terminal devices (computers and facsimile). Also, messengers will no longer be a service provided by signal units but will instead be provided and controlled by the unit itself.[32] Given the above, applying communications technology to doctrine has now become of interest to all of us.

Communications technology has provided two excellent C3 systems to assist the commander in command and control of the battle. The systems discussed above are survivable, mobile and versatile. They provide the commander an unprecedented capability to talk to key leaders in his organization over secure circuits from practically any location on the extended battlefield. He is free as never before to move to critical areas during the battle without losing contact with his command posts. He will benefit from these capabilities, however, only if the systems and nets remain well-disciplined and free of "information clutter".

With the forgoing discussion in mind, we will now consider what it all means to the commander on the ground. How will decentralization and his means of communication combine to improve combat performance?

V. Analysis and Evaluation

We have examined the subject of information needs and communications means in several ways: through historical review; by considering the impact of doctrine; and by discussing how current technology can be applied to that doctrine to provide the commander with an efficient command and control system. What, then, have we discovered, and what does it mean to Army leaders today? Several major themes from our discussion thus far deserve analysis: decentralization, the quest for information, C3 system vulnerabilities and the need for realistic training and detailed planning.

History has shown that decentralization of tactical control is a must on the modern battlefield. The tempo of combat operations on the high intensity battlefield will make concentrations of enemy forces difficult to find and fix. A commander must be able to take advantage of fleeting tactical windows of opportunity by acting and reacting faster than the enemy expects. The commander must be able to direct forces to the decisive point, or if a subordinate has used initiative, to synchronize his action and integrate it into the overall effort. The only way to accomplish these tasks effectively is through decentralized control.

Martin van Creveld shows through historical example

that commanders have attempted to deal with uncertainty in one of two ways.

> One was to construct an army of automatons following the orders of a single man, allowed only to do that which could be controlled; the other, to design organizations and operations in such a way as to enable the former to carry out the latter without need for continuous control. It is one basic contention of the present study that the second of these methods has, by and large, proved more successful than the first; and that, the ongoing revolution in the technology of command notwithstanding, this is likely to remain so in the future and indeed so long as war itself exists.[33]

With this in mind, he goes on to suggest four implications for the design of command systems:

> a. the need for decision thresholds to be fixed as far down the hierarchy as possible and for freedom of action at the bottom of the military structure; b. the need for an organization that provides self contained units at a fairly low level; c. the need for a regular reporting and information transmission system working from the top down, and from the bottom up; and d. the need for the active search for information by headquarters in order to supplement that routinely sent to it by the units at its command.[34]

Item d. above serves to recall the discussion earlier on the "directed telescope". The discussion that follows points out why item a. is so important.

> Commanders and their staffs must be able to discipline their C3I systems to reduce the amount of information by focusing on those information requirements which are

critical to combined arms, joint and coalition success.[35]

We have seen that the "quest for information" rose at an exponential rate once rapid and dependable communications were extended to the foxhole. Current doctrine, however should serve as a good appetite suppressant. " It is absolutely essential that each corps and division determine its specific information requirements because the command and control system will rapidly become choked with unneeded information."[36] Advocates of Auftragstaktik would remind us that commanders ....

> must decide what types and volumes of information they want from their staffs and subordinate commanders in wartime, then insist ruthlessly on elimination of every report failing to meet a specified need."[37]

If freedom of action is not granted to leaders at the lower levels of the military structure, it can only mean that commanders have opted for continuous control. Yet, the rapid tempo of battle will not permit continuous control; events will overtake and quickly destroy the decision cycle of any commander attempting continuous control. Decentralized control then is not an option, it is mandatory.

Another dilemma for commanders is that responsive, reliable communications have become indispensable for synchronization on the battlefield, yet considerable degradation of the technical means of communications must also be expected in a future high intensity war. Soviet operational

maneuver groups, in addition to Spetznaz and other deep strike forces may wreak havoc in the rear areas.

The Soviets may also exploit another C3 weakness. Current tactical radio assets are not sufficiently protected against the potential threat use of high-altitude (60 to 300 miles) nuclear explosions. Even in a conventional war, a detonation of this nature could be used by the Soviets for the purpose of destroying electronic devices, without fear of escalation to general or even limited nuclear war. The electromagnetic pulse (EMP) produced by such an explosion would disable unprotected electronic equipment within an area equal to that of the Continental United States. Although inexpensive "fixes" are available on the order of $30 per radio system, very few tactical radio systems are protected.[38] A "come as you are" war would find these assets extremely vulnerable to EMP.

SINCGARS and MSE offer the best solutions yet to the many C3 challenges that will face our forces on the AirLand battlefield. Even with their many fine features, however, both MSE and SINCGARS have "warts" or vulnerabilities. There is a false impression that because a radio signal is encrypted it cannot be jammed or located by direction finding equipment. An encrypted signal can in fact be just as easily jammed and located as a transmission "in the clear". The benefit of encryption is that it eliminates interception and enemy deception measures. MSE radios operate on single frequencies and are therefore

vulnerable to enemy direction finders and destructive fires.

Even protection provided by frequency hopping radios such as SINCGARS will not be foolproof. If frequencies are compromised, the enemy can search only those frequencies used in the hopping pattern, thus greatly increasing his chances of matching the hopping pattern for interception and destruction/jamming. Threat radio interception capability for tracking a frequency hopping radio must be assumed. As the frequency hopping rate is increased, however, REC assets must be increasingly sophisticated to "follow" the hopping pattern. When the same frequencies are used for multiple nets, C3 countermeasure systems lose their ability to distinguish nets and therefore cannot jam or direction find. SINCGARS provides security against interception and jamming through the use of such overlapping frequencies on different nets.[39]

Finally, although MSE's "electronic brain" is very sophisticated, the radio, operating frequencies, and siting requirements of present multichannel equipment remain the same for MSE.

It is obvious that the communications system must not be considered the backbone of the C2 system. Trust should be placed first in better command and less control. If too much reliance is placed on radio communications systems and they fail at a critical moment, synchronization of the battle will be jeopardized. On the other hand, if commanders at all levels are

prepared to continue the battle in the absence of communications, their initiative, in keeping with the commander's intent, may win the battle.

Commanders cannot, therefore, place total reliance on electronic communications to maintain control on the battlefield. The enemy will be selective in employing his REC assets; he will be careful to choose the most opportune moment in bringing to bear his considerable capability to disrupt C3. "U.S. transmitters will be targeted on a priority basis ... as indicated in the ... enemy's REC doctrine."[40] We need to train now to be able to respond to these threats to our C3 systems.

There are several reasons that commanders rarely have to deal with the harsh realities of total communications failure. For one, exercise scenarios never allow a significant degradation of the communications system; the communications support must be available to make the most of the training dollars spent in marshalling the other exercise players. Granted, there are usually sufficient communications outages to cause no small amount of consternation on the part of commanders and staff. Compound the usual vagaries of signal communications with the effects of combat operations and the resulting responsiveness of the C3 system will not likely meet peacetime exercise expectations. Clausewitz advises us "to plan maneuvers so that some of the elements of friction are involved, which will train officers' judgement, common sense and resolution."[41]

We need to stress the expectation of chaos in order to prepare leaders and soldiers for the stress of combat. Once a unit is committed, "it will fight in an environment of uncertainty, and commanders will have to rely on a clear understanding of their commander's intent as a guide to action."[42]

The four command control functions traditionally used still apply in AirLand battle: planning, directing, controlling and coordinating. It is in the planning of operations that we must anticipate information needs and provide them to subordinates. This will reduce information needs during the execution stage and significantly reduce the requirement to use the radio in accomplishing the remaining three C2 functions.

Information needs will differ from an offensive mission to a defensive mission. In the offense, control measures such as phase lines, axis of advance and objectives take on significance as means to control forces in the event of communications failure. The initiative belongs to the attacker and he therefore may have less need to communicate than the defender. What he does need to communicate are points of enemy weakness (success) and the orders to concentrate his forces in that area. In the defense, control measures such as trigger points, boundaries and battle hand-over lines are important. The need to shift forces to block penetrations or to take advantage of an exposed enemy flank assume communications responsive and

reliable enough to provide that flexibility. These and other thoughts should surface while planning operations to help eliminate questions that might arise at inopportune moments on the battlefield.

What can we say then concerning communications means and information needs? Discussions on the subjects of decentralization, the quest for information, C3 system vulnerabilities and the need for realistic training and detailed planning become meaningless if no practical application can be made. The challenge is to find ways to implement and test current doctrine while we are at peace so that we may be prepared for war.

VI. Conclusions/Recommendations

AirLand Battle doctrine is now being taught and implemented throughout the Army; SINCGARS and MSE are in the process of being fielded. The decisions made and methods used to integrate doctrine and technology now rest in the hands of leaders in combat, combat support and combat service support units. They will ultimately decide the efficacy of doctrine and the use of available C3 assets. More importantly, they will profoundly influence the future generation of Army leadership.

Those future leaders must understand that technology does not supplant command and control; it only increases its efficiency. SINCGARS and MSE will prove to be invaluable tools in the hands of our commanders, but they are not ultimate communications systems that will somehow solve the Army's command and control problems. In the event that these C3 systems become degraded or fail, it will be incumbent on junior leaders to accept the responsibilities and increased burdens that decentralized control places upon them.

Senior leaders must in turn realize that the era of continuous control is dead. Commanders must resist the great temptation to retain direct control. When the communications system functions perfectly and is not stressed, continuous control may in fact work. It is when the "fog of war" and chaos of battle strike that the practice of continuous

control established in peacetime exercises will prove disastrous. We must wholeheartedly accept the concept of decentralized execution and all that it entails before any progress can be made in reducing communications needs.

Leaders at all levels must appreciate what technology can and cannot do for them. Establishing hot loops and dedicated circuits will degrade MSE's capabilities and be counterproductive; commanders must know what the trade-offs are when using these special capabilities. It is more important than ever before for commanders and their staffs to have an accurate appreciation for the strengths and weaknesses of the MSE and SINCGARS communications systems and how their employment can affect the maneuver plan. The corps commander, for example, has twenty-two MSE node centers at his disposal and may "weight" the communications support significantly for the main effort. SINCGARS and MSE must be employed to make the most of their potential capabilities, especially considering the trend toward user owned and operated communications equipment.

The final conclusion is that however painful it may be, we need to test communications outage procedures and train in that environment. Only then can we be assured that the use of mission orders and commander's intent have begun to influence our combat operations.

There are many ways to reduce the quantity of combat information and intelligence information on the battlefield, and

at the same time, speed its transfer. I recommend the Army consider these as a minimum:

1. Experiment with new methods for rapid transfer of information by using facsimile to transmit matrix operations orders, decision graphics for unit status, course of action sketches and combinations of the above. The use of graphics to depict personnel, weapons and supply status is perfectly adaptable to facsimile and gives the commander a rapid picture of a unit's capability. Also, use alternate means of communications such as messengers whenever possible. Do not send a forty page facsimile message when it may take only a half hour to deliver it by courier.

2. Review current required reports/summaries and examine ways to shorten them, i.e. transmit updated intelligence summaries that include only changes, not the entire document. This reduces the time required to glean vital information and also reduces the transmission time.

3. Include the communications officer in the planning of operations, from the very outset, to ensure that C3 assets and capabilities are used in the best manner possible.

4. Stress lateral communications as much as we do higher to lower; they may well be far more important for execution using a concept of decentralized control. To stress this point, Men Against Fire should be required reading for all army leaders.

5. With regard to logistics, encourage the push system to ensure provision of critical supplies while at the same time reducing communications requirements.

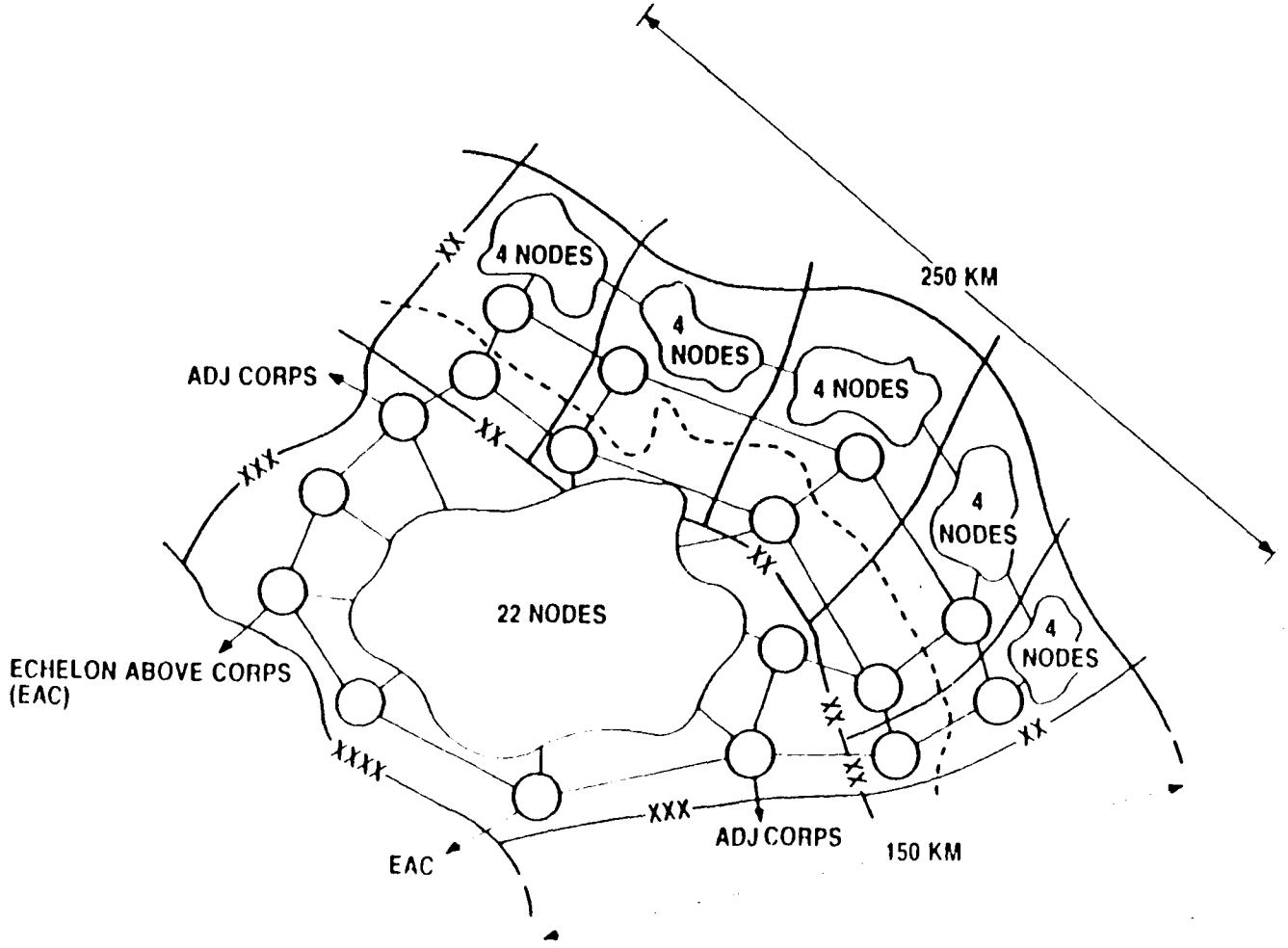
6. Perhaps most importantly, develop in junior leaders the ability to recognize what elements of information are critical to their commanders. Much time must be invested to train them on what to report and when. Just as the commander's intent must be known by everyone in the chain-of-command, so must we stress the commander's critical information requirements to subordinate leaders.

We may sympathize with Moshe Dayan as he reflected on command:

> Where, oh where are the good old days of the simple wars when, as the hour of battle approached, the commander got on his white horse, someone blew the trumpet, and off they charged towards the enemy![43]

Reality, however, is that today's battlefield is highly complex. In the realm of command and control, victory will go to the army that avails itself of all possible technological advantages, yet maintains the ability to control the battle with degraded C3. Balancing communications means with information needs at all levels of C3 efficiency is everyone's business; it is a vital step towards maintaining the effective command and control required to implement the Army's current AirLand Battle doctrine.

MSE Deployment
42 Nodes



MSE Architecture

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